STEREO Space Weather Group Update

Space Weather Group Website:

- **Group leaders: Dave Webb & Doug Biesecker**
- **Website updated last October:**
  http://secchi.nrl.navy.mil/index.php?p=SpaceWeather
  Webmaster is Lynn McNutt of NRL/SECCHI
- **Contains background on SWx, SWx-related meetings, PI SWx, tools/projects, references & links**
- **Could maintain a list of URLs/links that all PI teams could use**
  *** Example is the LMSAL EUVI site:**
  http://secchi.lmsal.com/EUVI/
  *** Sam Freeland (LMSAL) is updating the 'Latest Events" site to include at least SECCHI data**
  *** Will link this to SSWx site; also to a new SWx Events page**
- **Maintain member list with email addresses**
  Contact me to join (david.webb@hanscom.af.mil)
- **Tools/Projects list**
  Need updates from each team
  Interactions with STEREO Teams & SSC

E WEATHER TOOLS

ic Localization of STEREO CMEs (V. *Pizzo & D. Biesecker, 2004; NOAA*)
zing a series of LOS's from two views to define the location, shape, size &
of CME. To be automated & used to decide whether & when CME will impact Eart

del Predictions *(N. Arge, J. Luhmann, D. Biesecker; AFRL, UCB, NOAA;*
& Pizzo, 2000)
g-Sheeley-Arge and ENLIL 3D MHD solar wind models will be integrated.
routine predictions of vector solar wind velocity, density, temp. & mag. polarity
e desired. Also a joint AFRL/CISM/SEC project.

tection:
– Computer Aided CME Tracking *(E. Robbrecht & D. Berghmans, 2005; ROB)*
ltime tool for detecting CMEs in SECCHI images. Outputs: QL CME catalog
ures of time, width, speed; NRT CME warnings. Successfully tested on SOHO
MEs. Test version available at http://sidc.oma.be/cactus.

Solar Eruptive Event Detection System *(J. Zhang et al.,; GMU)*
detecting, classifying & analyzing CMEs in SECCHI images. Outputs: Automatic
alog w/measures of time, width, speed; NRT CME warnings. Being tested on
MEs.

d Automatic CME Detection Algorithm (*E. De Jong, P. Liewer, J. Hall,*
& R. Howard) ; JPL, NRL
m based on feature tracking which uses 2 successive images to determine
or not a CME has occurred. Algorithm to be run on board spacecraft.

E-Related Features Detection:

mputer Aided EUVI Wave and Dimming Detection
Podladchikova, D. Berghmans, A. Zhukov; ROB;
Podladchikova & Berghmans, 2005)
T tool for detecting EUV waves & dimming regions. Tested on SOHO EIT images.

ocity Map Construction *(J. Hochedez, S. Gissot; ROB)*
gram to analyze velocity flows on SECCHI images; detect CME onsets & EUV wav
T warnings of fast CMEs; reconstruct 3D velocity maps of CMEs from 2D maps fr
h STEREO.

omatic Solar Feature Classification *(D. Rust, P. Bernasconi; JHU/APL)*
l for detecting and characterizing solar filaments and sigmoids
ognition & Classification in solar images.
l is to meas. magnetic helicity parameters & forecast eruptions using
ments & sigmoids.

SPACE WEATHER – ENABLING PROJECTS

Identifying and Tracking CMEs with the Heliospheric Imagers ***(R. Harrison, C. Davis; RAL)***
Produced simulations to show model CMEs can be identified & tracked with HIs. Use triangulation to measure speed & direction of CMEs & forecast their Earth arrival.

Structural Context of Heliosphere Using SMEI Data ***(D. Webb, B. Jackson; BC/AFRL, UCSD; Jackson et al., 2006)***
Use analyses of SMEI images to provide structural context of the heliosphere for COR2 & HI. Also provide complementary observations of transient disturbances.

Interplanetary Acceleration of ICMEs ***(M. Owens; BU)***
Construct acceleration profiles of fast ICMEs over a large heliocentric range using multi-point HI to understand the forces acting on ejecta. Improve predictions of arrival times of ICMEs at Earth.

Relationship Between CMEs and Magnetic Clouds ***(S. Matthews; MSSL)***
Assess the potential geoeffectiveness of CMEs based their association with magnetic clouds. What particular characteristics lead to production of a magnetic cloud?

3D Structure of CMEs (*V. Bothmer, H. Cremades, D. Tripathi; MPI, Ger., Cambridge, UK; Cremades & Bothmer, 2004*)
Program to compare analysis of SECCHI images on the internal magnetic

DATA BROWSERS AND VIEWERS

STEREO Science Center Real-Time Data Pages *(W. Thompson et al)*
Main public site fro viewing R/T STEREO data.
http://stereo-ssc.nascom.nasa.gov/beacon/beacon_secchi.shtml

Solar Weather Browser *(B. Nicula, D. Berghmans, R. van der Linden; ROB)*
User-friendly browser tool for finding & displaying solar data & (SWB) context information. Available at http://sidc.oma.be/SWB/

STEREO Key Parameters *(C. Russell & IMPACT, PLASTIC & SWAVES teams; UCLA)*
An easily browseable Merged Key Parameter data display including the in-situ & SWAVE radio data from STEREO.

Carrington Rotation In-situ Browser *(J. Luhmann, P. Schroeder UCB)*
Browser for identifying in-situ events & their solar sources at CR-time scales.
Includes near-Earth (ACE) data sets for third point views & image movies from SECCHI & near-Earth (SOHO).
See: http://sprg.ssl.berkeley.edu/impact/data_browser.html.

JAVA-3D Synoptic Information Viewer *(J. Luhmann, P. Schroeder UCB)*
JAVA-3D applet for viewing 3D Sun & solar wind sources based on synoptic solar maps & potential field models of the coronal magnetic field.

Radio and CME Data Pages *(M. Pick et al.)*
Ground radio imaging and spectra; movies; S-WAVES SECCHI summary

Incorporating Data from Other Sources

- ***Existing Data:*** **ACE, Wind WAVES & EPACT (MeV protons), SOHO, TRACE, SXIs, Hinode, Ulysses, SMEI, IPS**

- ***Future Data:*** **SDO, MWA/IPS (Faraday rotation), new heliospheric imagers, Sentinels/Solar Orbiter, FASR**

Are special arrangements needed?

How to combine in-situ & imaging data?

- **At SEC Leslie Mayer (Nick Arge) will work on incorporating the STEREO locations into WSA model. Doing as part of generalization of WSA code:**

*** Both mag field expansion factor and the minimum angular distance → open field footpoint to nearest coronal boundary determined by tracing individual field lines down to surface. These two quantities used in an empirical formula to calculate solar wind speed.**

*** The solar wind speed and coronal mag field values determined for each sub-Earth point (at 5 Rs) are then used to predict SW parameters at L1 using 1D kinematic SW model.**

*** Generalizing code so model can be fed orbital coordina of other spacecraft (e.g., STEREO A & B or ULYSSES) or planets and SW**

Space Weather Events pages

- **Based on old ISTP Sun-Earth Connection Events site:**
  http://www-istp.gsfc.nasa.gov/istp/events/

Example: 2000 Events

Sun-EARTH Connection Event: July 14-16, 2000
X-Class Flares and Fast moving Earth-directed CME. The aurora reached as far south as Georgia (although not visible as during daylight) and Great Britain.

Sun-EARTH Connection Event: June 6-9, 2000
Large flares and a high speed halo CME - but no geoactivity.

Sun-EARTH Connection Event: April 4-7, 2000
Large Geophysical event causing the aurora to be visible as far south as the Carolinas.

- **Will contain an event summary, online dat & links to other data**
  Example: IMPACT Event page for Dec. 2007
  Need to incorporate or link other STEREO data:
  - **Beacon (NRT quicklook)**
  - **SECCHI & SWAVES imagery**
  - **PLASTIC & IMPACT in-situ plots**

NOAA/SEC Beacon Update

(Doug Biesecker)

Strategy for Beacon tools:

- The tools being developed at SEC are for internal use.
  External customers can be accommodated if SEC management approves.
- Ingesting the EUVI jpg images for couple of weeks.
  The jpgs are used in a basic movie tool at SEC.
- EUVI 195A images have been used to issue Coronal Hole Reports (a daily product)

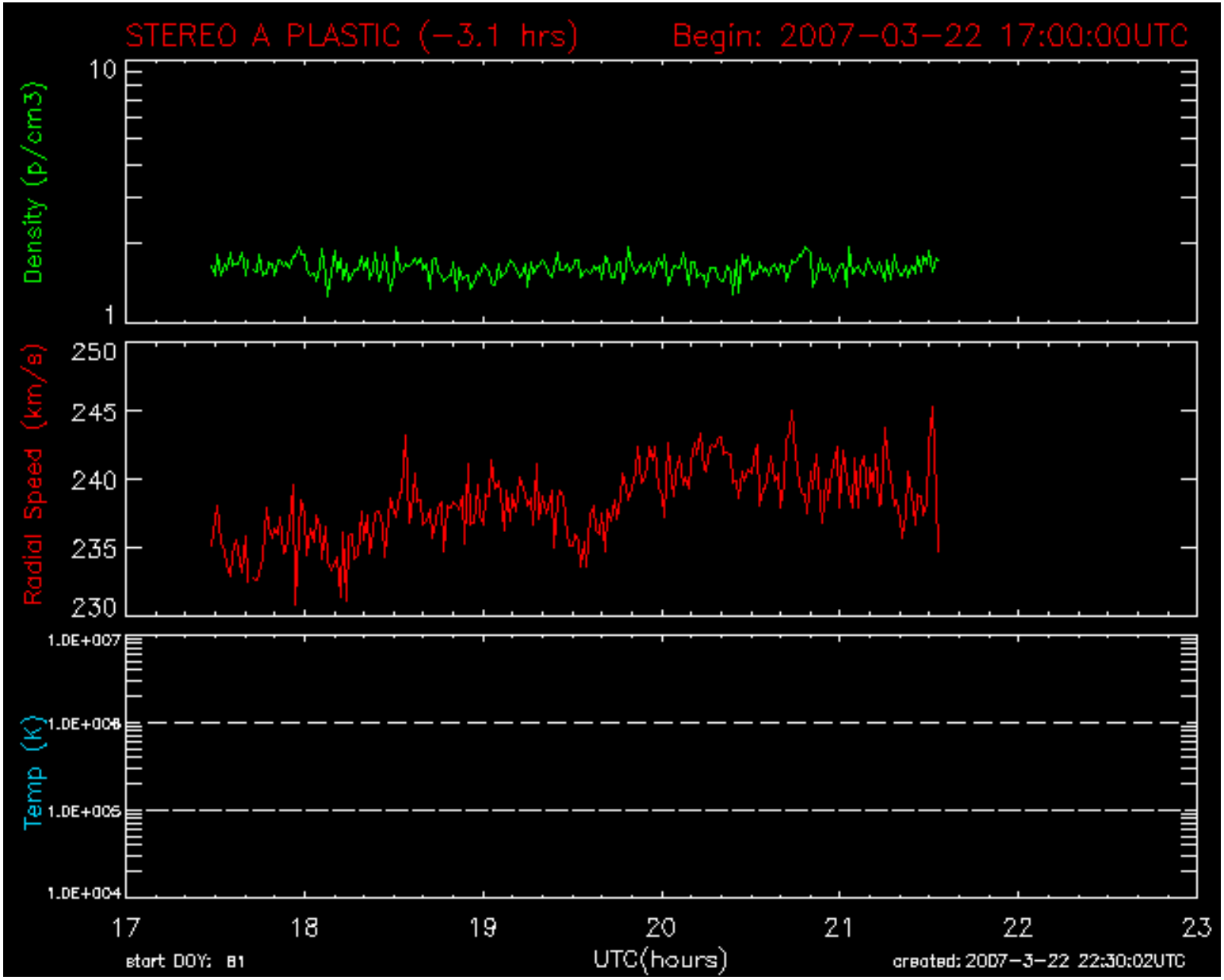
Status of Beacon Data

- Ingest of the PLASTIC and IMPACT cdf files pending (possibly March 22/23).
- SECCHI fits files to be ingested soon.
  * Would like the SSC to be producing jpg versions of the COR1, COR2, HI1, HI2 data as well, but still working with SECCHI to determine the optimum binning/compression.
  * NRL did upload a new plan on March 19, binning COR2 a bit more and using less compression, but have not assessed the new images.
  * HI1 data looks promising, but HI2 data very noisy and may require more work.

- For Solar Wind plotting (Plasma- Plastic; Mag fields & Particles- Impact)
  * Using same ACE RTSW dynamic plots page ideas (http://www.sec.noaa.gov/ace/)
  * So far, the only plots developed are 2, 6, 24 hour Solar Wind (n, V, T).
  Basic plots: Mag field & Plasma, Low Energy Electrons & Protons, & HighEnergy Protons at 2, 6, 24 hours.
  Then add 3 and 7 day plots.

Outside Interest

PLASTIC-A Solar Wind Plasma 6-hour Test Plot



Update continued

How to use SWAVES data/displays for space weather?

- **Type II, IIIs freq (distance) vs time plot**
- **with imaging & in-situ experiments**

CCMC use of STEREO data as inputs to models

- **Clearly has space weather context**

<u>Future SWx meetings:</u>

- **Updates at all SWGs & SECCHI Consortia**
- **Do we want a separate Space Weather workshop sometime?**

<u>Interfaces with</u>:

- **3D Reconstruction & Visualization Team**
- **Virtual observatories**
- **IHY (add CIPs related to STEREO data & analyses)**
- **Outreach aspects**
  - **With NASA EP/O & PAO efforts; Press Releases?**
  - **Separate SWx Poster (thru NRL)?**
  - **Possibly a feature article in Space Weather journal**